

Timeless and Thoroughly Modern: Maple Syrup Production in the Twenty-first Century

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BACKGROUND

The collection of sap from dormant maple trees in eastern North America predates European arrival on the continent. While written accounts of maple production by Native Americans from early French explorers exist from the late 17th century, a far richer oral history of how early cultures came to produce a sweet product from maple trees is best told by members of those cultures themselves.

Fundamentally, maple sap and maple syrup are nontimber forest products (NTFP). This fact immediately creates both challenges and opportunities for communication and engagement with stakeholders as well as adoption of specific management strategies as compared to traditional northern hardwoods forestry. The techniques used to harvest sap for a large extent of the history of maple production were dependent on a certain pattern of weather during the spring harvest season. Modern methods and equipment have allowed for sap to be collected during times when historical methods would not.

While the technology used to harvest maple sap has evolved over time, several fundamentals remain unchanged. The process still requires drilling holes to expose conductive xylem tissue of dormant trees. Although the maple industry standard for tap hole diameter has decreased by nearly 30 percent over the past 30 years (from 7/16 inch to 5/16 inch) the trees' wound response mechanism to tapping injury remains unchanged (Heiligmann et al. 2006). The active process of compartmentalization with the trees results in annual accrual of a volume of nonconductive wood (Walters Shigo 1978). New annual growth adds conductive wood. Recent research shows that tree size is strongly and linearly related to syrup yield (Isselhardt et al. 2018).

For more than 150 years, maple sap was harvested most commonly as a component of other agricultural production on small farms across the eastern United States and Canada. According to USDA statistics in 1909, there were 87,537 U.S. farms reporting maple production with an average of 216 taps/farm (USDA NASS 2021). The transition away from broadly distributed agricultural production in the early 20th century was swift and was reflected in the significant decline in production of maple sugar and syrup. Between 1909 and 1940, U.S. maple production declined by nearly 98 percent (Fig. 1). What followed was a roughly 50-year period of production on those farms and forests that remained active. Starting in the mid to late 1990s, a period of expansion began to take place in the country. The rate of expansion increased significantly to a point where U.S. current production has grown by 3.5 times in just the last 20 years (USDA NASS 2021). The average size of U.S. maple operations has also increased. According to the most recent USDA Census of Agriculture, the average size of U.S. maple operations is 1,410 taps/farm (USDA NASS 2021).

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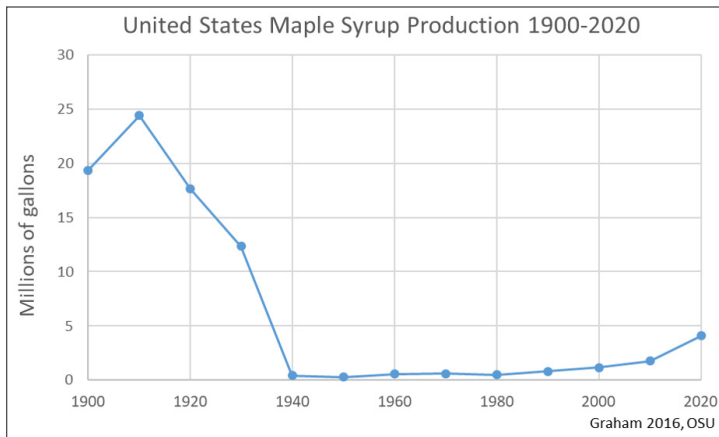


Figure 1.—Maple sugar production in the United States, 1900 to 2020. Data from Graham 2016.

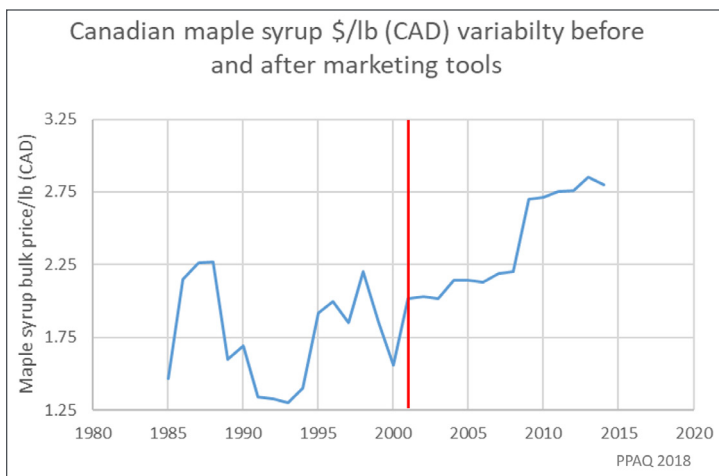


Figure 2.—Canadian maple sugar prices, 1985 to 2014, in Canadian dollars per pound of syrup.

CURRENT CONCERNS

Modern maple syrup production techniques involve the use of plastic tubing, vacuum pumps, and membranes to maximize sap yields, minimize labor costs, and reduce energy consumption in the processing of sap to syrup. Average sap yields have increased nearly 50 percent from ~0.2 gallons of syrup/tap 30+ years ago to >0.3 gallons of syrup/tap in 2020 (USDA NASS 2021). Research has shown that yields of 0.5 gallons of syrup/tap are achievable assuming modern technology, sanitation, and tree factors are followed (Isselhardt et al. 2018). Operation size is also an important factor as there are apparent economies of scale when adopting modern production technology. A recent survey of 312 maple producers from across the northeastern United States showed that approximately 81 percent of all reported syrup production came from producers with >5,000 taps although those operations translate to only 18 percent of all survey respondents (Cannella et al. 2021). There has been significant growth in the largest size operations over the recent past with a 9 percent increase in operations with >10,000 taps from 2002 to 2017 (USDA NASS 2021). Beyond the efficacy of large operations, the impact of Québec maple production and how that province's maple producers are organized helps explain the expansion of maple in the United States.

The Québec Maple Syrup Producers (QMSP) represents nearly 11,300 maple producers through a series of government sanctioned marketing tools including: provincial subsidies, favorable leases on publicly owned “crown land,” a quota system for controlling supply, and establishment of a strategic reserve of syrup. Following the implementation of the marketing tools and policies in the late 1990s and early 2000s the bulk price for pure maple syrup saw a reduction in volatility that was historically significant given the crop's reliance on ideal weather during the 6 to 8 week production season (Fig. 2; Hall 2013).

ECONOMICS

The financial returns for maple syrup production are variable. Net returns for a small group of producers in the Northeast who participated in a University of Vermont Extension Service financial benchmarking project averaged \$122/acre in 2019 with a range from -\$295 to \$605 (Cannella and Lindgren 2021). One factor that can contribute to the relative profitability of a given maple operation is access to crop trees. Many maple producers lease a portion or all their trees. Lease rates are variable and, in one report from Vermont, ranged from \$0.5 to >\$2.00/tap (Isselhardt 2017). The highest lease prices were paid for properties in areas with increased competition from other maple producers. Operations with excess sap processing capacity appear to be willing to pay more for leases.

Third party certification of organic maple syrup production has grown significantly in the United States. Although synthetic pesticides are rare in maple production, it is only until the operation has been inspected and shown to follow certification guidelines that the operation can market their product as certified organic. Standards vary among organizations but all require producers to follow a forest management plan that includes provisions for good forestry and maintaining species diversity. In 2008, the first-year records were compiled, 25 percent of the U.S. maple syrup crop was certified organic. In 2019, that number has more than doubled to 59 percent (USDA NASS 2021). The premium paid for certified organic syrup (~10 to 15 percent compared to “conventional” syrup) combined with the relatively low cost of obtaining certification helps explain recent trends.

Given the considerable time it takes for maple trees to become large enough to tap, the growth of maple production in the United States over the last 30 years has come from existing northern hardwood stands, many of which were at the time in active management for timber production. While the rate of growth in maple production has been dramatic, in terms of percent of trees capable of being tapped, the number remains relatively low. By some estimates only a few percent of the “tappable” trees in the nation are currently tapped. Vermont leads in terms of utilizing maple forests for sap production in the United States. Vermont maple producers tap roughly 12 percent of the 32 million potential taps in the state compared to Michigan that taps <1 percent of its 69.7 million potential taps (Matthews and Iverson 2017).

LOOKING FORWARD

Given consumer trends globally toward more natural, minimally produced foods and recent patterns of consumption, it appears that maple syrup is well positioned to benefit with increased demand. Gaps in the science as to the how modern sap collection methods and forest management activity can coexist remain to be filled. Approaches to incorporate species and structural diversity and examining how carbon forestry techniques that balance both sequestration and storage with acceptable yields of sap on a per-acre basis will be important in the near term.

LITERATURE CITED

- Cannella, M.; Isselhardt, M.; van den Berg, A.; D’Amato, A.; Lindgren, C. 2021. **The Northeast maple economy: crop distribution and outlook**. Maple Syrup Digest. 28A(2): 19–26. <https://mapleresearch.org/wp-content/uploads/economy0321.pdf> (accessed Oct. 25, 2022).
- Cannella, M.; Lindgren C. 2021. **2019 Northeast maple business benchmark**. Pub. FBRR043-05/21. Burlington, VT: University of Vermont Extension 16 p.

- Graham, G. 2016. **Maple syrup production statistics. An updated report to the North American Maple Syrup Council.** 29 p. <https://www.uvm.edu/sites/default/files/Agriculture/maple-statistics-report-2016-graham-osu.pdf> (accessed June 20, 2021).
- Hall, D. 2013. **Federation of Quebec maple syrup producers: past, present and future.** Vermont Maple Conference; 2013 January 13. Presentation recording available at https://www.youtube.com/watch?v=sHTOUUKUjyM&feature=emb_title (accessed June 20, 2021).
- Heiligmann, R.; Smallidge, P.; Graham, G.; Chabot, B. 2006. **Managing maple trees for sap production.** In: Heiligmann, R.B.; Koelling, M.R.; Perkins, T.D., eds. North American maple syrup producers manual, 2nd edition. Columbus, OH: Ohio State University Extension: 31–80.
- Isselhardt, M.; Perkins, T.; van den Berg, A. 2018. **Tree size and maple production.** New England Society of American Foresters News Quarterly. 79: 5–6.
- Isselhardt, M.L. 2017. **A snapshot at sugarbush leases in Vermont.** The Maple News. Aug/Sept: 8. <https://www.uvm.edu/sites/default/files/media/a-snapshot-at-sugarbush-lease-rates-in-vermont-2017.pdf> (accessed October 25, 2022).
- Matthews, S.N.; Iverson, L.R. 2017. **Managing for delicious ecosystem service under climate change: can United States sugar maple (*Acer saccharum*) syrup production be maintained in a warming climate?** International Journal of Biodiversity Science, Ecosystem Services & Management. 13(2): 40–52. <https://doi.org/10.1080/21513732.2017.1285815>.
- Walters, R.; Shigo, A. 1978. **Tapholes in sugar maples: What happens in the tree.** Gen. Tech. Rep. NE-47. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experimental Station. 12 p.
- USDA National Agricultural Statistics Service [USDA NASS]. 2021. **NASS quick stats.** Washington, DC: U.S. Department of Agriculture, National Agricultural Statistics Service. <https://data.nal.usda.gov/dataset/nass-quick-stats>. Accessed 2021-06-24 (accessed June 20, 2021).

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